Original

Copy No.

File in t

ZH-29-018

CAC 29 XP024-4

CONSOLIDATED VULTEE AIRCRAFT CORPORAT

DEVELOPMENT ENGINEERING

SAN DIEGO, CALIFORNIA

CONSOLIDATED AIRCRAFT CORPORATION
SAN DIEGO, CALIFORNIA

MODEL XPB2Y-4 AIRPLANE REPORT NO. ZH-29-018

XPB2Y-4

HYDRODYNAMIC CHARACTERISTICS

Part I

Spray Strips Installed

FOREWORD

Reported herein is an analysis of flight tests conducted on the XPB2Y-4 airplane, equipped with Wright R-2600-10 Engines, to determine the hydrodynamic characteristics with spray strips installed. Three power settings were used; namely, 1800, 1700, and 1200 BHP/Engine. The latter power was used to simulate the characteristics of the normal PB2Y-3 airplane, and was not used in excess of 72,500 pounds gross weight which is the practical limiting load for that power. Due to a restriction of only four take-offs at 1800 BHP/Engine, the data at this power are necessarily limited.

Additional tests with spray strips removed will be reported at a later date as Part II of this report.

BY

CHECKED

APPROVED

SUMMARY

1. Spray Characteristics:

The spray height with spray strips installed was considerably reduced over the standard hull. No solid water entered the engines at any gross weight up to, and including, 76,000 pounds. At no time was the spray through the propellers severe even though the majority of tests were run in moderately rough water with c.g.'s as far forward as 22% M.A.C.

The rate of acceleration had a marked effect on spray duration and intensity becoming very light with increased power.

A tabulation of spray height for various gross weights and powers is given in Table I and the corresponding spray pictures, enlarged from moving pictures of the take-offs, are presented in Figures 10 - 12. An accurate comparison between spray strips on and off will be given in Part II of this report.

2. Longitudinal Stability:

Results show an adequate range of stable c.g. positions for all gross weights up to, and including, 76,000 pounds.

The isolated effects of acceleration, flap and elevator deflection were determined and each shows a marked effect on stability and must be considered in any stability analysis. These data are summarized in Table I and Figures 2 - 8.

3. Directional Stability:

Directional stability during take-off is satisfactory and improved rapidly with increased power (acceleration). By maintaining 0 degree flaps until planing is established, direction may be maintained by aileron and rudder. Deflecting flaps prior to hump speed seriously aggravate directional stability. With flaps 20 degrees, partial throttle is necessary to maintain direction.

4. Landing Stability:

All landings at all gross weights were satisfactory with no evidence of skipping indicating PB2Y-3 production

BY__________

CHECKED__________

APPROVED__________

SUMMARY
(contd.)

step ventilation is adequate up to, and including, 76,000 pounds gross weight.

5. Take-Off:

Take-off times are summarized in Table I and Figure 9. Computed and actual times are in very close agreement, indicating towing basin resistance tests and C.V.A.C. integration method to be extremely accurate.

CONCLUSIONS

1. Spray strips on the production PB2Y-3 airplane at 72,500 pounds, in moderately rough water, eliminates spray through the engine and results in a marked decrease in the heavy spray through the propellers.

2. The XPB2Y-4 airplane at 76,000 pounds gross weight with R-2600-10 engines and spray strips will have moderately heavy spray through the lower 40% of the propeller radius for a duration of 5 seconds.

3. The effect of acceleration on spray and particularly stability characteristics is so great that towing basin tests will be seriously in error unless conducted with powered models which are run at the correct acceleration for the power in question.

4. Beam loading is not the major parameter of hydrodynamic performance as has been commonly believed. Reducing the power loading from 13.75 lbs./BHP to 11.2 lbs./BHP (18.5% reduction) resulted in practically identical stability and spray and an 18% reduction in take-off time for an increase in beam loading from $C_{\Delta_0} = .89$ to $C_{\Delta_0} = 1.03$ (equivalent to a 15% increase in gross weight).

5. Step ventilation as installed on the production PB2Y-3 airplanes is adequate for gross weights up to, and including, 76,000 pounds.

6. Directional instability is primarily dependent upon flap deflection and may be eliminated at all gross weights by maintaining flaps 0 degrees over the hump.

BY ____________

CHECKED ____________

APPROVED ____________

DISCUSSION

A. Effect of Spray Strips on the Hydrodynamic Characteristics of the PB2Y-3 and XPB2Y-4 Airplanes

Brief:

The spray strips installed on the XPB2Y-4 were developed by the N.A.C.A. at the request of the Bureau of Aeronautics to permit operation of the PB2Y-3 airplane at a gross weight of 72,500 pounds without excessive spray entering the engines or propeller disc. To expedite the full scale testing of this item, it was installed on the XPB2Y-4 airplane and its effectiveness for application to the PB2Y-3 airplane was determined with reduced throttle to give PB2Y-3 power and acceleration.

Inasmuch as the spray strips were installed on the XPB2Y-4, the tests were extended to determine the effect of the spray strips up to, and including, 76,000 pounds, using XPB2Y-4 take-off power.

Results:

The spray strip as installed on the XPB2Y-4 airplane is illustrated in Figure 1. Observations of the spray characteristics were made for gross weights of 58,000, 66,000, 70,000, 72,500, 74,000 and 76,000 pounds with center of gravity locations varying from 32 to 22% M.A.C. At all gross weights, observations were made at 1700 BHP/Engine. From 58,000 to 72,500 pounds gross weight, observations were made using 1200 BHP/Engine in addition to the 1700 BHP runs, in order to simulate the production PB2Y-3 airplane. As four take-offs at the production rating of 1800 BHP/Engine were allowed by the engine manufacturer, two additional runs at 76,000 pounds were made using this power.

For direct comparison, a moving picture record at each power was obtained at a c.g. of 27% M.A.C. for the 66,000, 72,500, 74,000 and 76,000 pound conditions. Summary spray pictures enlarged from these records are shown in Figures 10 through 12. Tabulated data obtained from these records and direct observationsare given in Table I.

For all gross weights, powers and c.g.'s tested, the spray was satisfactory for service operation. The maximum intensity was obtained at 72,500 pounds with the PB2Y-3 power (1200 BHP/Engine). The spray improved greatly with

BY

CHECKED

APPROVED

increased power and at 76,000 pounds with 1700 and 1800 BHP/Engine the spray was considerably reduced over the worst condition at 72,500 pounds.

The majority of the tests were run in moderately rough water and the conclusions reached should represent average service operation.

From the results obtained to date the spray strip apparently has had no effect on stability or handling characteristics. This subject, in addition to a direct comparison of spray with and without the spray strip, will be covered in Part II of this report when tests are completed with the spray strip removed.

B. Effect of Power loading and Gross Weight on the Hydrodynamic Characteristics of the XPB2Y-4 Airplane

Brief:

Several years ago flight tests on the XPB2Y-1 with 4200 BHP and the XPB2Y-2 with 4800 BHP, both at 66,000 pounds gross weight, indicated that spray and hydrodynamic stability characteristics were not entirely dependent upon beam loading, but were mainly dependent upon power loading (acceleration). Very great improvements in spray, stability and control were obtained at the increased power. As a matter of fact, the XPB2Y-1 with 4200 BHP at 66,000 pounds was very similar in all respects to the normal production PB2Y-3 at 72,500 pounds without spray strips; whereas the production airplane with 4800 BHP at 66,000 pounds has proved very satisfactory.

Based upon these data it appeared that if power loading was reduced sufficiently, the gross weight of the PB2Y type airplanes could be increased to 76,000 pounds, maintaining satisfactory stability and spray.

The XPB2Y-4 with R-2600-10 engines rated at 1700 BHP/Engine for take-off has a power loading of 11.2 lbs./BHP at 76,000 pounds gross weight, as compared with 13.75 lbs/BHP for the PB2Y-3 at design gross weight of 66,000 pounds.

Preliminary tank tests, conducted on a powered dynamic model of the PB2Y, indicated that the 18.5% reduction in power loading would amply compensate for the 15% increase in gross weight.

BY________

CHECKED________

APPROVED________

The experimental R-2600-10 engines installed in the XPB2Y-4 for these tests were limited to 1700 BHP/Engine; whereas the normal production rating is 1800 BHP. This restriction did not seriously affect the results of the tests. Permission was granted by the Bureau of Aeronautics to make four take-offs at 1800 BHP/Engine which were reserved for spray observations and take-off time measurements at the maximum loading of 76,000 pounds. All stability data were obtained at the lower power of 1700 BHP.

Results:

The hydrodynamic characteristics of a flying boat are greatly affected by power loading and beam loading. The following discussion will consider these effects on each of the major hydrodynamic characteristics;

1. Spray:

Due to the presence of the spray strip it was difficult to note progressive changes in spray height with gross weight or power as the height was held nearly constant for all conditions. However, the intensity of the spray varied over a wide range as did the duration. High intensity of spray invariably accompanied long spray duration. The reverse, however, is not necessarily true.

At constant power there was a definite increase in spray intensity with increasing gross weight, or beam loading, as is normally expected. This increase developed at a very rapid rate as the acceleration over the hump became less than 1.0 ft./sec.^{2}. However, this increase in spray intensity is not necessarily due to the increase in beam loading alone for as the gross weight is increased for constant power the power loading is increasing as well.

As a result of the observations made it was determined that if the power was increased sufficiently to give a net percentage decrease in power loading equal to the percentage increase in gross weight or beam loading, the spray intensity remained practically constant, provided the acceleration at the hump remained in excess of 1.0 ft./sec.^{2}.

For example:

At 66,000 pounds gross weight and 1200 BHP/Engine, the power loading is 13.75 lbs./BHP and the beam loading is

C_{Δ_o} = .89. The acceleration at the hump for this condition is 1.18 and the spray duration was 5.0 seconds.

At 76,000 pounds gross weight and 1700 BHP/Engine, the power loading is 11.2 lbs./BHP and the beam loading is C_{Δ_o} = 1.03. This is a net decrease of 18.5% in power loading for the increase of 15.8% in beam loading. The acceleration at the hump for this condition is 1.78 ft./sec.^{2} and the spray duration was 8 seconds.

The spray duration was slightly longer due to the added wetted length of forebody ahead of the propellers. However, the spray intensity per unit of time was somewhat reduced due to the added acceleration. The net difference between the above conditions with regard to propeller erosion appears to be nil.

A more thorough study of spray, as affected by acceleration and beam loading, will be reported in Part II of this report where the spray patterns will not be modified by the presence of the spray strip.

2. Stability:

Figures 2 through 8 present the effects of varying power loading and beam loading on the hydrodynamic stability characteristics. As in the case of the observations on spray, acceleration has a marked effect.

Figure 2 is the basic plot and contains all of the actual test points. It is plotted in the form described in Reference 2 where the maximum amplitude of oscillation attained during an accelerated run to near getaway with the elevator fixed is plotted against center of gravity position in % of the mean aerodynamic chord. This method is known as determining the center of gravity limits and has proved through extensive full scale and model testing to be the most practical procedure for defining hydrodynamic stability.

The forward c.g. limit of stability has been defined as that c.g. position where a maximum oscillation of ±1.0 degree is obtained with the elevators locked at 0 degrees. This definition allows enough conservatism to provide for inaccurate loading in service and rough water. It will be noted that the application of 10 degrees of up elevator is sufficient in most cases to move the limit forward an additional 3 or 4% M.A.C.

BY

CHECKED

APPROVED

The aft c.g. limit of stability has been defined as that c.g. position where a maximum oscillation of ±1.0 degree is obtained with the elevators locked up at 5 degrees. This limit has been modified from one previously established by this company for model tests wherein an angle of 25 degrees of up elevator was specified. This modification has been the result of an extensive full-scale survey of the take-off technique of a number of pilots, which indicated that seldom is more than 5 degrees of up elevator used during the take-off run, particularly if the c.g. is in the aft of normal range. The 25-degree elevator, in light of this survey, is deemed unnecessarily conservative.

It should be noted at this point that all full scale stability data were obtained with the elevator control locked in the specified test condition. This was accomplished by installing a "snap release" collar on the push-pull column and with a slight forward pressure it bore on a bearing plate. In this manner, up elevator was free and in an emergency down elevator could be applied by releasing the snap or overpowering the collar which required approximately a thirty-pound push. This system, of course, did not interfere in any way with free aileron control. To obtain consistent data, it is imperative that the control be locked to eliminate the inherent tendency of the pilot to damp oscillations with application of elevator.

Figures 3 through 7 are crossplots of the basic data in Figure 2 intended to isolate various effects. Figure 3 is a standard summary stability plot showing the limits of stability vs. gross weight for various flap deflections. From a plot such as this the correct take-off flap technique for maximum stability range may be determined. The advantage of using 0 degrees flap for extreme forward c.g. locations gradually increasing to 20 degrees flap for the extreme aft is obvious. Information of this nature is vital to the pilot in service to accomplish his varied missions satisfactorily or, in some cases, at all.

Figures 4 and 5 are interesting inasmuch as they show clearly the effect of acceleration as determined full scale. It was extremely fortunate that such a wide range of power loadings were available for these tests at such a relatively high beam loading. It should be noted that the destabilizing effect of power alone is included in these plots (Reference Fig. 8b) which results in the net effect of acceleration, as determined in the towing basin, checking full scale very closely. These figures clearly indicate the

serious error present in towing basin tests if the correct acceleration, for the power involved, is not used.

Figures 6 and 7 give the effects of flap and elevator on stability. These effects are large and cannot be neglected. As a matter of fact: with these data known, a careful pilot can greatly extend the useful c.g. range of his airplane by the correct application of these controls.

Figures 8a, 8b, and 8c are plots taken from Reference 1, which reports towing basin tests conducted with a 1/8 scale powered dynamic model of the XPB2Y-4, and are included to show the correlation of acceleration effect between model and full scale. An interesting example of acceleration is seen in Figure 8b where an increase in power from 1200 BHP/Engine to 1700 BHP/Engine, both run at the standard towing basin acceleration of 1.0 ft./sec.^{2}, resulted in a 2-1/2% M.A.C. destabilizing effect. Figure 8c, however, indicates a 4.65% M.A.C. improvement in forward limit if the model had been accelerated to the correct acceleration for that power. The net result in the forward limit at 1700 BHP/Engine is actually 2.15% M.A.C. forward of the 1200 BHP/Engine case instead of 2.5% M.A.C. behind. Without the correct acceleration being applied, the erroneous conclusion that increasing power full scale will be destabilizing would have been drawn.

3. <u>Take-Off</u>:

The take-off data are summarized in Table I and Figure 9. The effects of power loading and gross weight are clearly indicated. All data are corrected to zero wind for comparison. The outstanding result indicated here is the exceptional accuracy of the computed take-off times, indicating very accurate resistance curves as obtained from the towing basin and 3 and 4 blade propeller data as obtained from N.A.C.A. T.R. #640. It should be noted that these times are for the first attempted take-off, no opportunity being given to allow the pilot to make slight corrections to his technique. At the higher gross weights, with practice, the times could have all been reduced somewhat. For this reason, these times probably represent service operation.

4. <u>General Handling</u>:

The general handling characteristics very definitely improved with gross weight and power. The main effect of gross weight was to reduce the static heel angle so that

at 76,000 pounds the static heel was almost zero. This required a minimum use of the ailerons to get on the step and facilitated maneuvering on the water in a cross wind. Increased power allowed more positive maneuvering control on the water and, due to the rapid acceleration, eliminated most of the low speed jockeying getting on to the step.

Directional stability improves rapidly with increasing load. This is also manifest at lighter gross weights, by leaving the flaps retracted throughout the take-off run prior to hump speed.

BY

CHECKED

APPROVED

CONSOLIDATED VULTEE AIRCRAFT CORPORATION
SAN DIEGO DIVISION . . SAN DIEGO, CALIFORNIA

XPB2Y-4 - FULL SCALE HYDRODYNAMIC TESTS

TABLE I

G.W.	(*1) BHP/ENG	(*8) Height of Spray in Propellers	(*3) Duration of Spray in Propellers	Hydrodynamic Stability Limits % M.A.C.				Take-Off Time Seconds (*2)	
				Fwd. Limit (*4)		Aft Limit (*5)			
lbs.		% Prop. Radius	Seconds	Pre-dicted	Flt. Test	Pre-dicted	Flt. Test	Pre-dicted	Flt. Test
66,000	1700	35	4		21.5		36	28.8	29
66,000	1200(*7)	45	5		24.0		34	58.0	58
70,000	1700	40	5		23.2		36	34.8	34
70,000	1200	50	8					90.0	99
72,500	1700	40	5		24.2		36	39.2	39
72,500	1200	50	12					122.	168
74,000	1700	40	6		24.8		36	42.7	42
76,000	1700	40	8	25.0	25.5	32.5	36	47.5	50.5
76,000	1800	40	5	No Predictions Made (*6)				42.7	43

*NOTE:
(1) Production Engine is rated 1800 BHP/Eng. @ T.O.
(2) All T.O. corrected to no wind (Ref. Diehl - Pg. 503)
(3) Spray compared at c.g. of 27% M.A.C. for all G.W.
(4) Fwd. Limit is for Flap 0°) see Fig. 2
(5) Aft Limit is for Flap 20°)
(6) Only 4 T.O. allowed at 1800 BHP/Eng. on experimental engines
(7) PB2Y-3 Power
(8) 55% Propeller radius is location of nacelle lower lip

CONSOLIDATED VULTEE AIRCRAFT CORP.

XPB2Y-4

HYDRODYNAMIC LIMITS OF STABILITY FOR TAKEOFF

(1700 BHP/ENG - WITH SPRAY STRIPS)

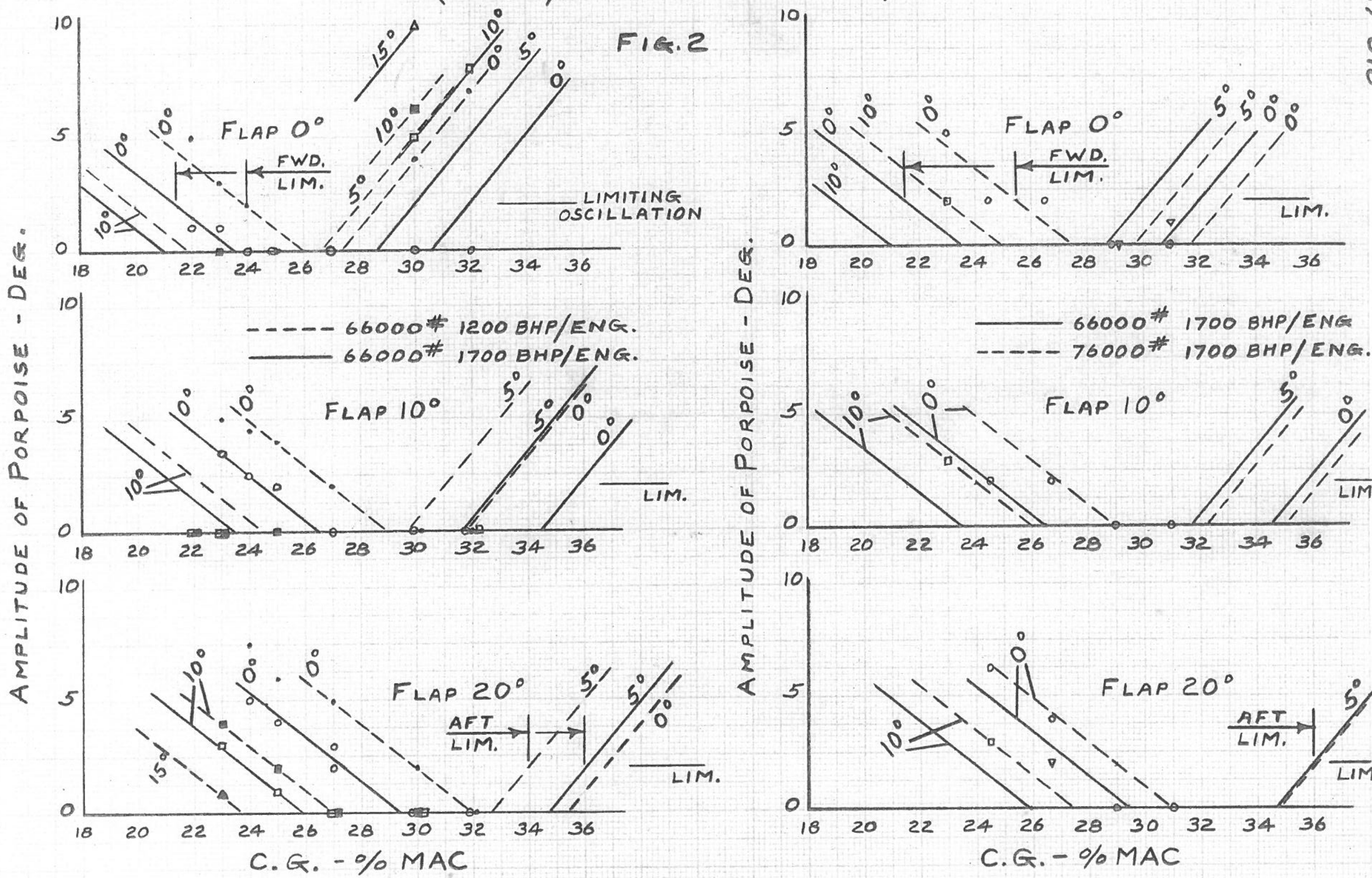


FIG. 2

Stout 5-31-43

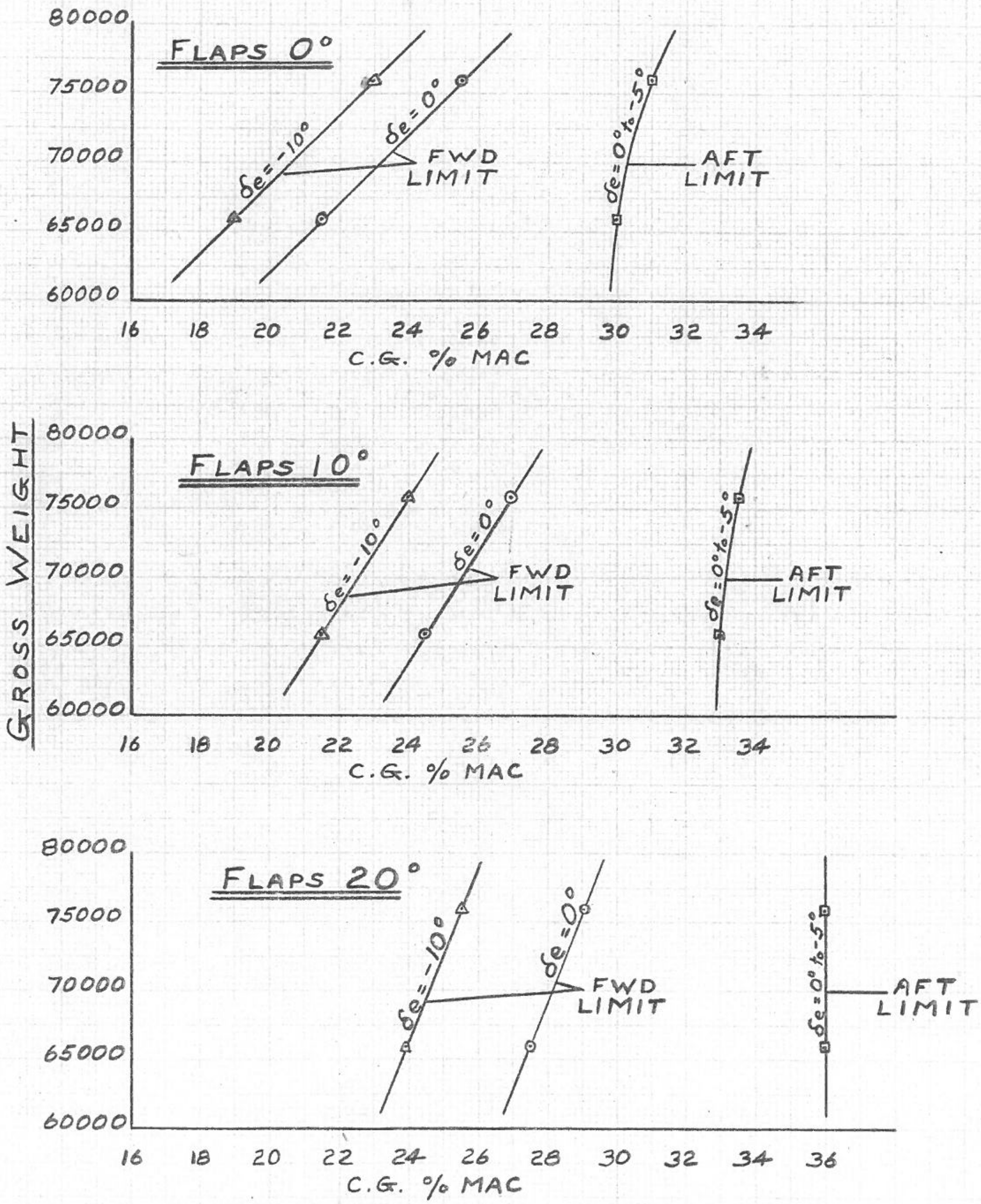
XPB2Y-4

HYDRODYNAMIC LIMITS OF STABILITY FOR TAKE OFF

(1700 BHP/ENG. - WITH SPRAYSTRIPS)

FIG. 3

NOTE: ALL DATA ARE CROSS PLOTS FROM FLIGHTS NOS. 3 - 10
LIMITS ARE DEFINED AS A ± 1.0 DEG. OSCILLATION



Stout 5-28-43

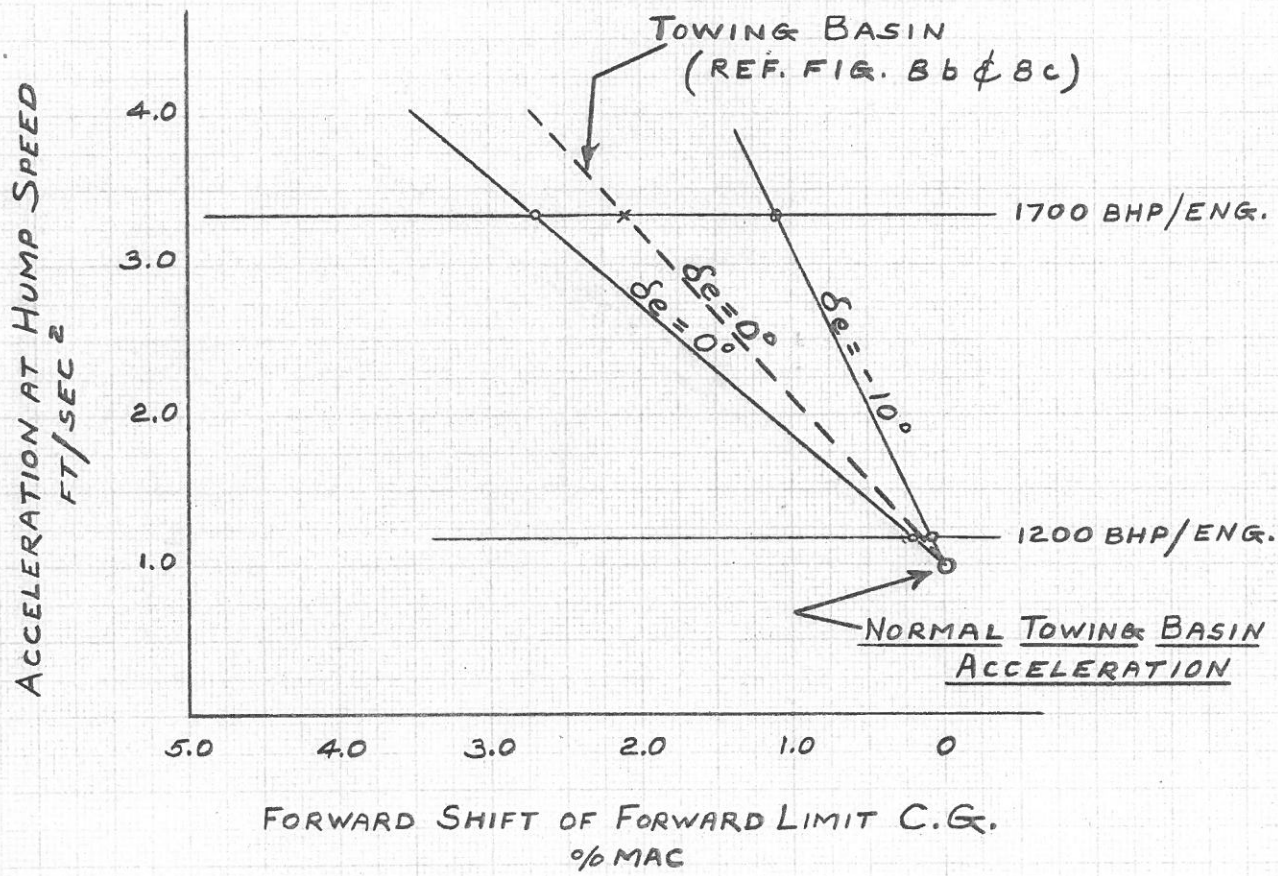
XPB2Y-4

EFFECT OF ACCELERATION ON THE FORWARD LIMIT OF STABILITY

GROSS WEIGHT 66000 LBS.

$C_{\Delta_0} = 0.89$

FIG. 4



NOTE: ALL DATA ARE CROSS PLOTS FROM FLIGHTS NOS. 3-10

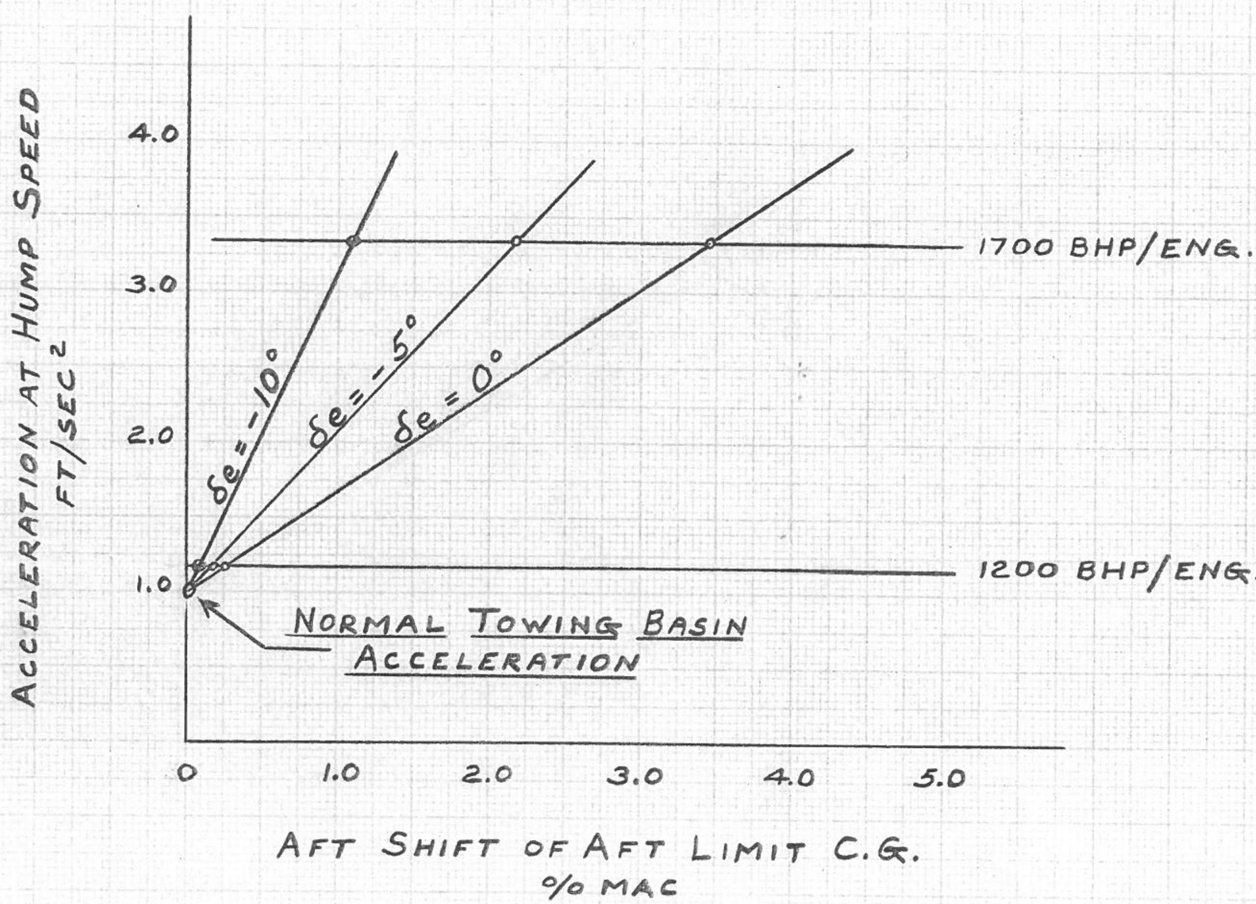
Stout 5-29-43

XPB2Y-4

EFFECT OF ACCELERATION ON THE AFT LIMIT OF STABILITY

GROSS WEIGHT 66000 LBS.

$C_{\Delta_0} = 0.89$



NOTE: ALL DATA ARE CROSS PLOTS FROM FLIGHTS NOS. 3-10

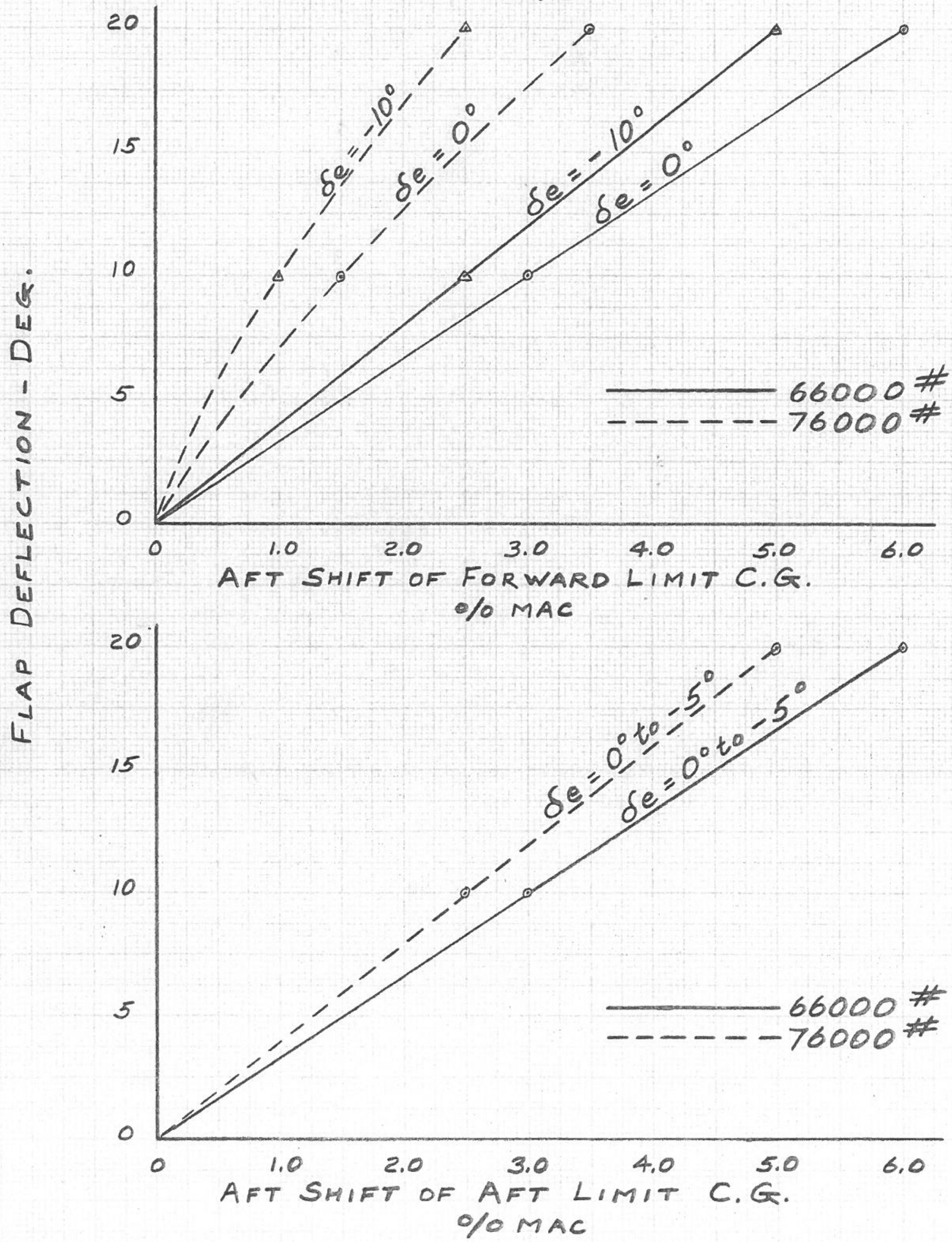
Stout 5-29-43

XPB2Y-4

EFFECT OF FLAP DEFLECTION ON THE FORWARD & AFT LIMITS OF STABILITY

(1700 BHP/ENG. - WITH SPRAYSTRIPS)

FIG. 6



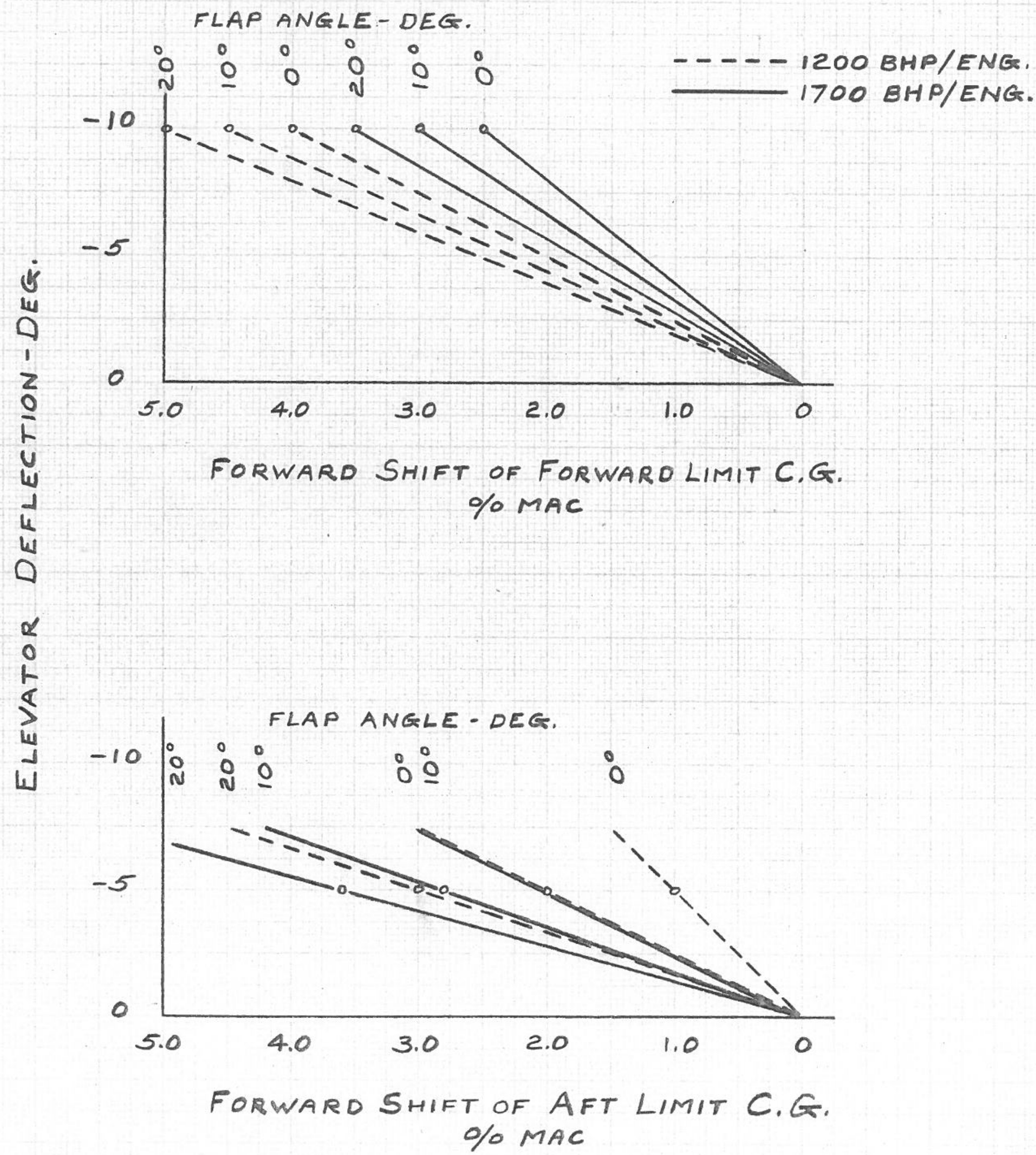
Stout 5-31-43

XPB2Y-4

EFFECT OF ELEVATOR DEFLECTION ON THE FORWARD & AFT LIMITS OF STABILITY

(66000 TO 76000 LBS. GROSS WEIGHT
WITH SPRAY STRIPS)

FIG. 7

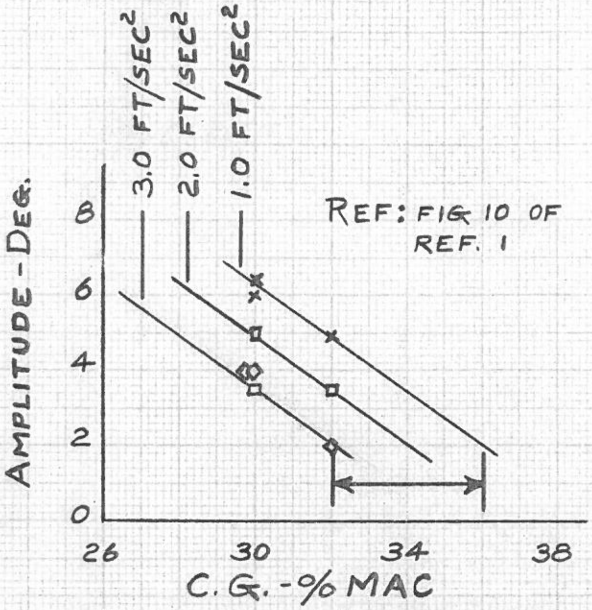


Stout 6-4-43

XPB2Y-4

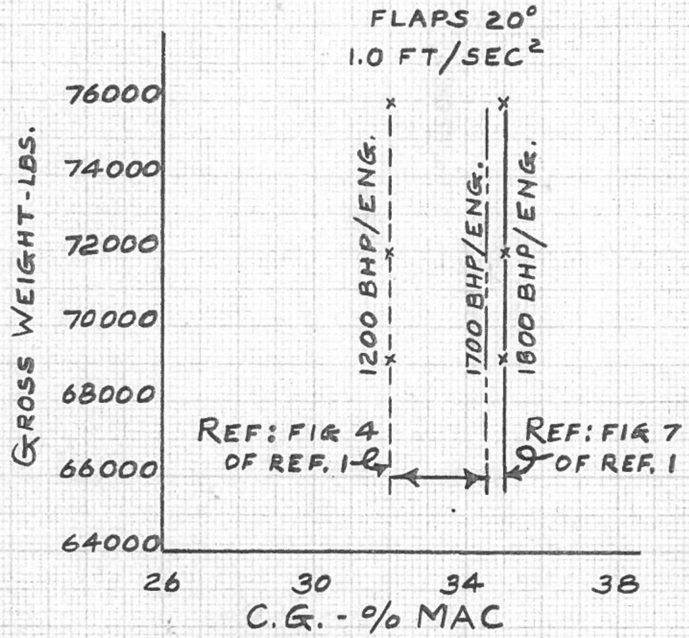
TOWING BASIN DATA

FIG. 8a



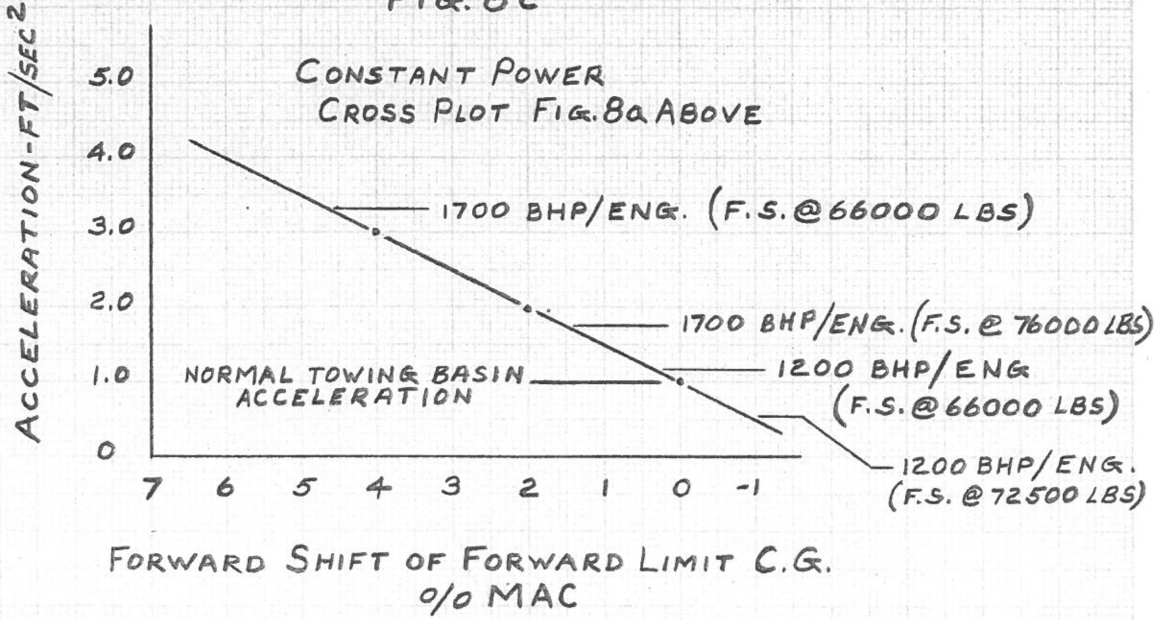
EFFECT OF ACCELERATION AT CONSTANT POWER

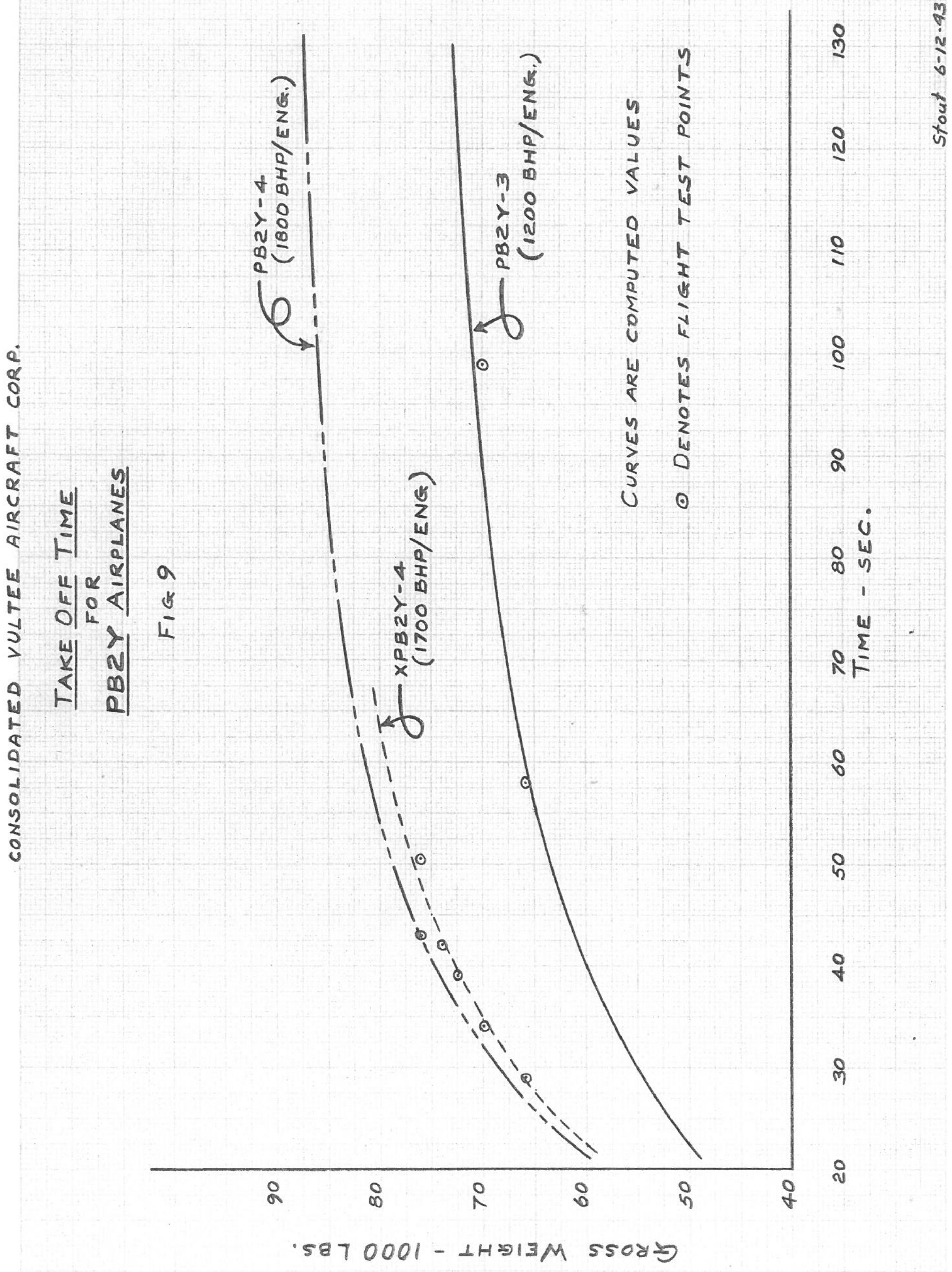
FIG. 8b



EFFECT OF POWER AT CONSTANT ACCELERATION

FIG. 8c




CONSOLIDATED VULTEE AIRCRAFT CORP.
TAKE OFF TIME
FOR
PB2Y AIRPLANES
FIG 9
PB2Y-4
(1800 BHP/ENG.)
XPB2Y-4
(1700 BHP/ENG)
PB2Y-3
(1200 BHP/ENG.)
CURVES ARE COMPUTED VALUES
⊙ DENOTES FLIGHT TEST POINTS
GROSS WEIGHT - 1000 LBS.
40
50
60
70
80
90
TIME - SEC.
20
30
40
50
60
70
80
90
100
110
120
130
Stout 6-12-43

10.01.19

Form 124 500M

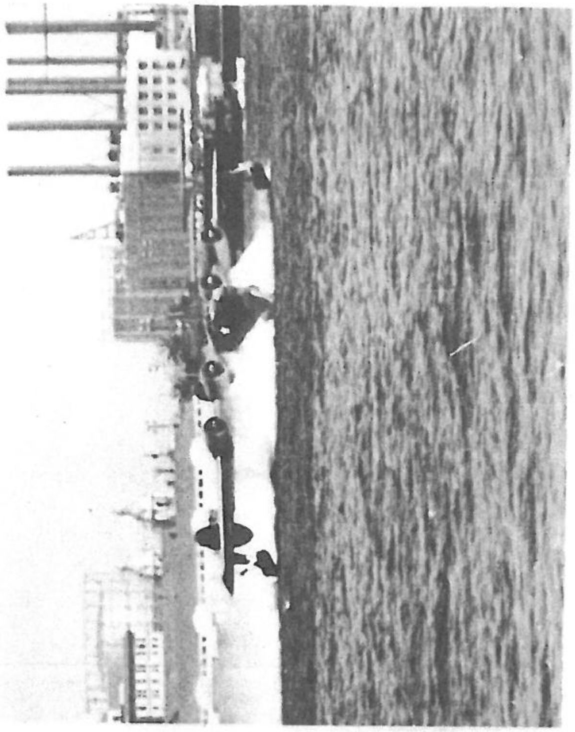
CONSOLIDATED VULTEE AIRCRAFT CORPORATION
SAN DIEGO DIVISION . . SAN DIEGO, CALIFORNIA
CALCULATION SHEET

PART I
PAGE 22

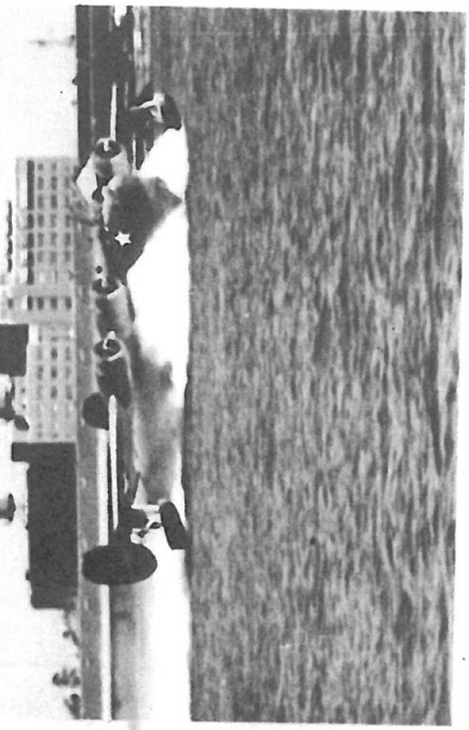
5667

ZH-29-01B

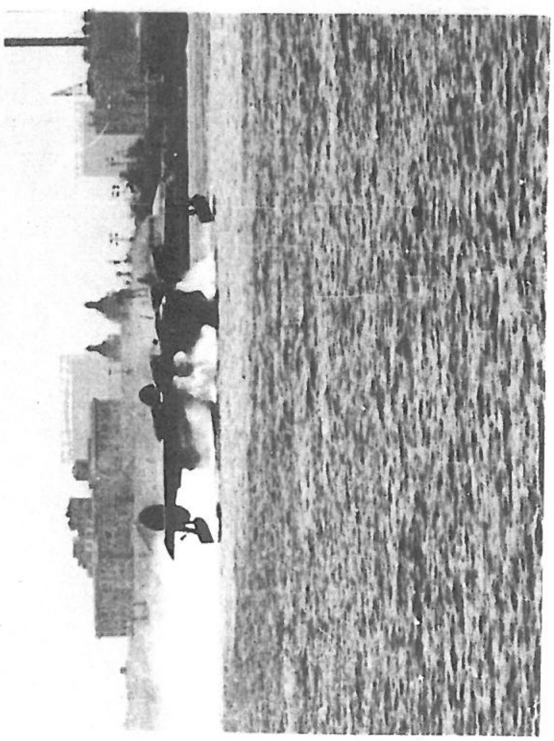
FIG. 10



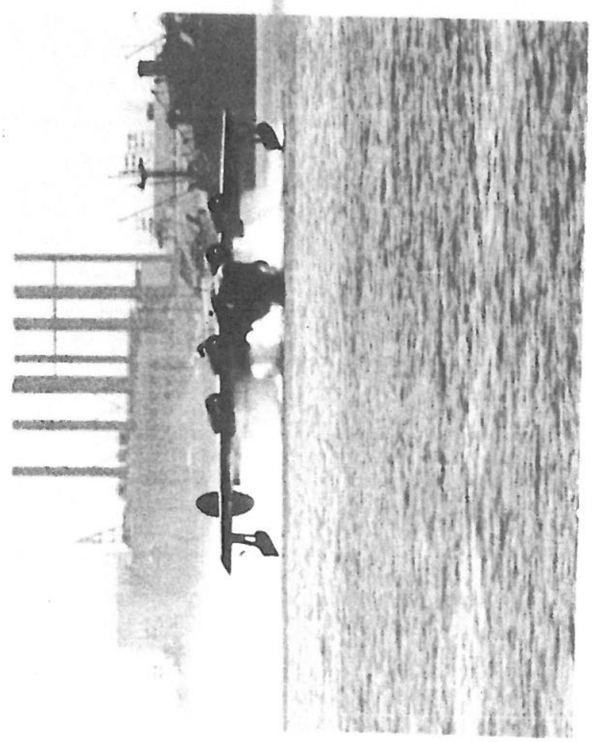
1200 BHP/ENG. 72500 LBS



1700 BHP/ENG 72500 LBS



1200 BHP/ENG. 66000 LBS



1700 BHP/ENG 66000 LBS.

CONSOLIDATED VULTEE AIRCRAFT CORP.

LINDBERGH FIELD, SAN DIEGO, CALIF.

Whoever, being intrusted with or having lawful possession or control of any document, writing, code book, blue print, plan signal book sketch, photograph, photographic negative, map model, note or information, relating to the national defense, through gross negligence permits the same to be removed from its proper place of custody, or delivered to anyone in violation of his trust, or to be lost, stolen, abstracted or destroyed, shall be punished by a fine of not more than $10,000, or imprisonment for not more than two years, or both.

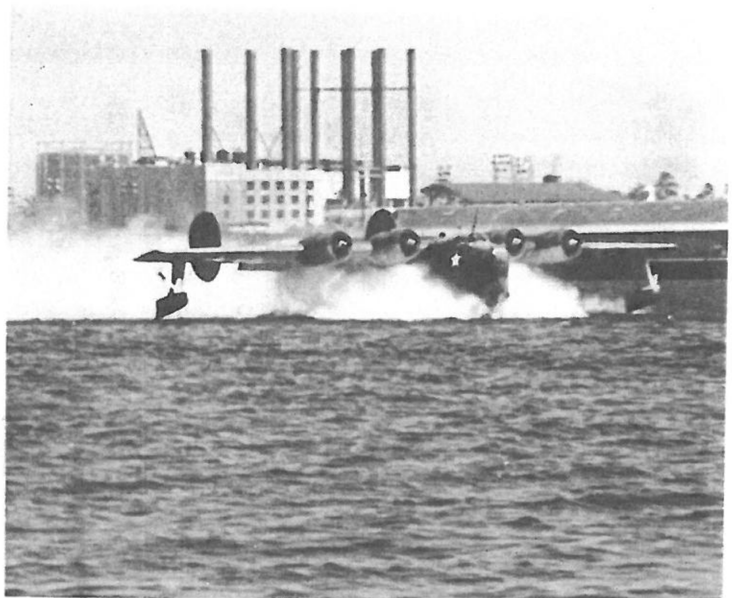
[redacted]

Form 124 500M

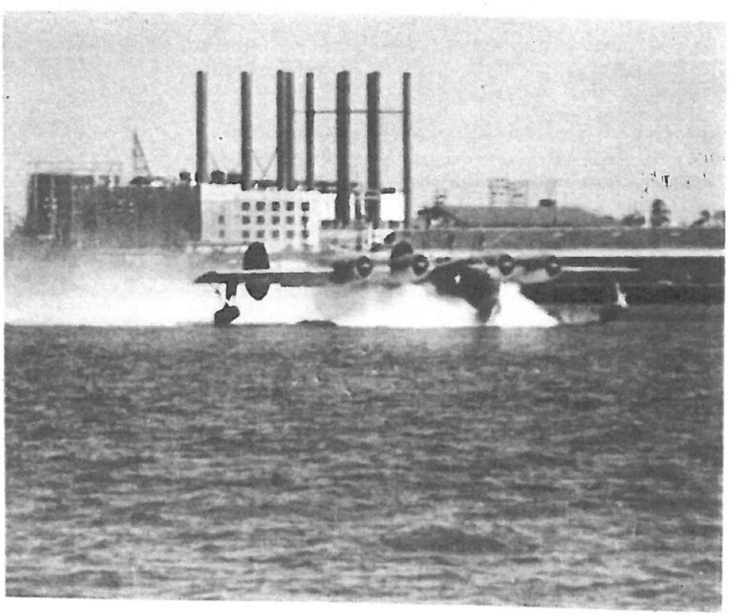
CONSOLIDATED VULTEE AIRCRAFT CORPORATION
SAN DIEGO DIVISION . . SAN DIEGO, CALIFORNIA
CALCULATION SHEET

ZH-29-018

FIG. 12



76000 LBS 1700 BHP/ENG.



76000 LBS 1800 BHP/ENG

[illegible] VULTEE AIRCRAFT CORP.

[illegible] FIELD, SAN [illegible], CALIF.

[illegible] lawful possession or control of [illegible], writing, code book, blue print, [illegible] sketch, photograph, photographic [illegible], model, note or information, relating to [illegible] defense, through gross neglig[illegible] permits the same to be removed from its proper place of custody, or delivered to anyone in violation of his trust, or to be lost, stolen, abstracted or destroyed, shall be punished by a fine of not more than $10,000, or imprisonment for not more than two years, or both.]

[redacted]

RETURN TO
HYDRODYNAMICS

975

REFERENCES

1. Preliminary Data for the Bureau of Aeronautics "Tank Tests of a 1/8 Size Dynamic Model of the PB2Y-3 Airplane with Power - N.A.C.A. Model 131 - Part II", dated March 12, 1943.

2. Stout, E. G., "Experimental Determination of Hydrodynamic Stability", Journal of the Aeronautical Sciences, Vol. 8, No. 2, dated December, 1940.

3. Consolidated Vultee Aircraft Corporation Flight Test Reports for the XPB2Y-4 Airplane. Flights No. 1 - 10, April 24, 1943 through May 25, 1943.

CONSOLIDATED AIRCRAFT CORPORATION
SAN DIEGO CALIFORNIA

FLIGHT REPORT

Model XPB2Y-4 Airplane No. 1638

Flight No. 1 Date April 24, 1943

Date of Report: MAY 23 1943

By W. G. Griswold

Checked A. J. Nadeau

Approved D. H. Bennett

Approved A. J. Savard

Form 624

FLIGHT REPORT

MODEL XPB2Y-4 AIRPLANE

No. 1638

Flight No. 1 Made: April 24, 1943

Purpose

The purpose of this test was to check the general water handling characteristics of the airplane with spray strip at R-1830-88 power and R-2600-10 power.

Results

The general handling and hydrodynamic characteristics of the airplane were as good as the PB2Y-3 airplane in all respects. Both high speed and low speed taxi runs were made to check the effect of the spray strip. Observation of the spray strip from the flight deck was somewhat restricted in that only the spray approximately 2 ft. out from the spray strip could be seen. The spray that could be observed was routed out and down from the hull and only light spray came in contact with the propellers. Due to the light gross weight of 56,000 lbs., the total effectiveness of the spray strip could not be determined. Future tests will determine the effectiveness of the spray strips at higher gross weights.

The following data display the hydrodynamic characteristics of the hull during the various taxi runs:

Run No.	Time to Hump(sec)	Speed at Hump (Knots)	Trim at Hump (Deg)	Planing Trim (Deg.)	Planing Speed (Knots)	Conditions
1	13	45	8	3	-	2250 RPM, 36"Hg. MP 20° flap, R-1830-88 P
2	13	45	8	3	-	2250 RPM, 36"Hg. MP 20° flap, R-1830-88
3	10	40	9	3	70	2800 RPM, 43"Hg. MP 20° flap, R-2600-10 P

Note: Planing speeds for the first two runs were not obtained because runs were terminated immediately after passing over the hump.

Results (cont'd)

With the R-2600-10 engines at 2800 RPM and 43 "MP, the time to hump and the hump speed was less than with the R-1830-88 power.

The shakedown flight which was scheduled was not run at this time because of poor operation of #2 engine. The cause of this poor engine operation was later determined to be dirty spark plugs.

CONSOLIDATED AIRCRAFT CORPORATION
SAN DIEGO, CALIFORNIA

FLIGHT REPORT

Model XPB2Y-4 Airplane No. 1638

Flight No. 2 Date April 27, 1943

Date of Report: MAY 28 1943

By W. G. Griswold
W. G. Griswold

Checked A. J. Nadeau
A. J. Nadeau

Approved D. H. Bennett
D. H. Bennett

Approved A. J. Savard
A. J. Savard

Form 624

FLIGHT REPORT

MODEL XPB2Y-4 AIRPLANE

No. 1638

Flight No. 2 Made: April 27, 1943

Purpose

The purpose of this flight was to make an initial shakedown flight.

Results

A 50 minute shakedown flight was completed with no undesirable flight characteristics present.

Readings of fuel flow, cylinder temperatures, fuel and oil pressure, oil temperature and carburetor air temperature were obtained at 800 ft. pressure altitude, 29 "Hg. M.P., 2000 RPM; at 5000 ft. pressure altitude, 29 "Hg., 2000 RPM and at 5,000 ft. pressure altitude, 39 "Hg. M.P. and 2400 RPM. Various cowl flap angles were also tested in flight.

The above readings were recorded by the flight engineer, and all indications are that the engine operation was satisfactory.

CONSOLIDATED AIRCRAFT CORPORATION
SAN DIEGO, CALIFORNIA

FLIGHT REPORT

Model XPB2Y-4 Airplane No. 1638

Flight No. 3 Date April 27, 1943

Date of Report: MAY 28 1943

By W. G. Griswold

Checked A. J. Nadeau

Approved D. H. Bennett

Approved A. J. Savard

Form 624

CONSOLIDATED AIRCRAFT CORPORATION
SAN DIEGO CALIFORNIA

FLIGHT REPORT

MODEL XPB2Y-4 AIRPLANE

No. 1638

Flight No. 3 Made: April 27, 1943

Purpose

The purpose of these tests was to determine the effects of acceleration, flaps and elevator deflection on the hydrodynamic stability characteristics of the airplane at 66,000# gross weight and a C.G. location of 27% MAC. Also to run a high speed cubic at 5600 feet density altitude.

Results

A. Taxi Tests

1. With full power, flaps 0° and elevator 0°, the airplane was stable.
2. With full power, flaps 10° and elevator 0°, the airplane was still stable.
3. With full power, flaps 20° and elevator 0°, the airplane had a maximum amplitude of porpoise of 5°.
4. With full power, flaps 20° and elevator 8° up, the airplane was stable.
5. With partial power corresponding to PB2Y-3 full power, flaps 10° and elevator 0°, an amplitude of porpoise of 2° was encountered. This was a pure acceleration effect since the airplane was stable under the same conditions with full power (see 2 above).

The above results checked predictions based on tank tests within 1%.

B. Take-Off

1. Take-off with full power and corrected to no wind was 29 seconds.

C. Landing

1. Five landings were made with no evidence of instability.

Results (contd)

D. High Speed Cubic

1. Speeds attained during the high speed runs are rather low in comparison to the prediction. Data obtained are considered unreliable because: (a) complete stabilization of the airplane was difficult due to erratic rate-of-climb indicators, (b) an XPB2Y-3 airspeed indicator calibration was used in working up the data, and (c) spray strips are installed on this airplane. Another high speed cubic will be run after the airspeed indicators on this airplane are calibrated.

CONSOLIDATED AIRCRAFT CORPORATION
SAN DIEGO, CALIFORNIA

FLIGHT REPORT

Model XPB2Y-4 Airplane No. 1638

Flight No. 4 Date May 1, 1943

Date of Report: MAY 23 1943

By W. G. Griswold
W. G. Griswold

Checked A. J. Nadeau
A. J. Nadeau

Approved D. H. Bennett
D. H. Bennett

Approved A. J. Savard
A. J. Savard

Form 624

FLIGHT REPORT

Page 1
Revised 6-25-43

MODEL XPB2Y-4 AIRPLANE

No. 1638

Flight No. 4 Made: May 1, 1943

Purpose

The purpose of this test was to determine the forward and aft C.G. limits of hydrodynamic stability at 66,000 lbs. gross weight.

Results

A total of 48 taxi runs was made with C.G. locations as far forward as approximately 21% MAC.

The forward hydrodynamic limits of stability of the airplane were determined and are summarized in the following table.

Flap Deflection (Degrees)	Elevator Deflection (Degrees Up)	C. G. Stability Limits** (% MAC)	
		Model PB2Y-3 @ 1200 BHP/Eng.	Model XPB2Y-4 @ 1700 BHP/Eng.
0	0	24.0	21.5*
0	10	20.0*	19.0*
10	0	27	24.5
10	10	22.5	21.5
20	0	30.0	27.5
20	10	25.0	23.9
20	15	21.7	-

*Note: Due to water leakage in the spray strip and forebody during testing at 23% MAC, all stability limits determined with wing flaps at zero degrees have been estimated from previous runs.

The aft limits were checked but are not considered reliable. These limits will be checked on the following flight.

**This table has been revised because of further extrapolation and fairing of curves from more complete data.

CONSOLIDATED AIRCRAFT CORPORATION
SAN DIEGO, CALIFORNIA

FLIGHT REPORT

Model XPB2Y-4 Airplane No. 1638

Flight No. 5 Date May 4, 1943

Date Submitted: JUL 1 1943

By R. C. Crowther
R. C. Crowther

Checked A. J. Nadeau
A. J. Nadeau

Approved D. H. Bennett
D. H. Bennett

Approved A. J. Savard
A. J. Savard

Form 624

FLIGHT REPORT

MODEL XPB2Y-4 AIRPLANE

No. 1638

Flight No. 5 Flight Made: May 4, 1943

Purpose

The purpose of this flight was:

1. To determine the aft C.G. limits of hydrodynamic stability at 66,000 lbs. gross weight.

2. To check general hydrodynamic characteristics of the airplane with spray strip at 70,000 lbs. gross weight with 2800 RPM, 43 "Hg. manifold pressure (1700 BHP) (185BMEP) and with 2400 RPM, 33 "Hg. manifold pressure (1200 BHP) (162 BMEP).

3. To check general hydrodynamic characteristics of the airplane during take-off and landing at R-2600-10 power, 70,000 lbs. gross weight.

4. To calibrate the pilot's, co-pilot's and navigator's airspeed indicators.

Results

1. A total of 17 taxi runs was made at 66,000 lbs. gross weight.

The aft hydrodynamic stability limits of the airplane were determined and are summarized in the following table.

Results (cont'd)

Flap Deflection (Degrees)	Elevator Deflection (Degrees Up)	Aft C. G. Limit (%MAC)	
		PB2Y-3 1200 BHP/Eng.	XPB2Y-4 1700 BHP/Eng.
0	0	28.6	32.0
0	10	27.0	28.0
10	0	33.0	34.0 +
10	10	29.0	30.0
20	0	34.0+	34.0 +
20	10	31.5	32.0

Note: 1. The C.G. limits of hydrodynamic stability for the 0° elevator and 20° flap condition are arbitrary limits and represent stable points, the actual limits being somewhere aft of 34% MAC. Since this is near the absolute aft aerodynamic C.G. limit, further aft C.G. positions were considered academic and were not tested.

2. No large up-elevator conditions should be maintained at C.G. positions aft of 29% MAC, as this will cause uncontrollable instability at high planing speeds.

2. A total of seven taxi runs was made at 70,000 lbs. gross weight. The general hydrodynamic characteristics of the airplane (with 70,000 lbs. gross weight using 1200 and 1700 BHP) appear satisfactory. The spray strips result in a considerable improvement of the spray condition. From past observations of the PB2Y-3 at this gross weight, spray appeared to enter the propeller disc as high as the spinner. With spray strips, however, only a finely divided spray enters the propeller disc up to 50% of the propeller radius.

The time duration in the spray region was reduced 52% with a 40% increase in power.

3. Three take-offs and landings were made at 70,000 lbs. gross weight. The take-off time at 70,000 lbs. gross weight (1700 BHP/Eng.) was 34* seconds, whereas the PB2Y-3 (1200 BHP/Eng.) required 99* seconds.

4. The airspeed calibration was not run because the gross weight had not decreased a sufficient amount by the time the taxi tests were terminated.

*Take-off time corrected to 0 wind.

CONSOLIDATED AIRCRAFT CORPORATION
SAN DIEGO, CALIFORNIA

FLIGHT REPORT

Model XPB2Y-4 Airplane No. 1638

Flight No. 6 Date May 14, 1943

Date of Report: JUL 1 1943

By R. C. Crowther
R. C. Crowther

Checked A. J. Nadeau
A. J. Nadeau

Approved D. H. Bennett
D. H. Bennett

Approved A. J. Savard
A. J. Savard

Form 624

FLIGHT REPORT

MODEL XPB2Y-4 AIRPLANE

No. 1638

Flight No. 6

Made: May 14, 1943
G.W.: 66,000 lbs.

Purpose

The purpose of this flight was:

1. To conduct a shakedown to check structural water-tightness of rebuilt spray strip.

2. To check hydrodynamic stability at C.G. locations of 22 and 24% MAC.

Results

Several simulated take-off runs were made to check the strength and water-tightness of the revised spray strip.

The spray strip proved to be quite sound and very effective in preventing the water from reaching the propellers; however, water leakage was quite evident as shown through the inspection windows to the spray strip.

Simulated take-offs were made for one hour, and at the end of that time, the spray strips were completely filled with water.

The hydrodynamic stability at 22% and 24% MAC was not tested. These C.G. locations were to be checked only if the spray strip had been water tight. However, the data obtained on the previous taxi test are considered reliable and these C.G. locations will not be checked again.

CONSOLIDATED AIRCRAFT CORPORATION
SAN DIEGO, CALIFORNIA

FLIGHT REPORT

Model XPB2Y-4 Airplane No. 1638

Flight No. 7 Date May 15, 1943

Date of Report: JUL 1 1943

By R. C. Crowther
R. C. Crowther

Checked A. J. Nadeau
A. J. Nadeau

Approved D. H. Bennett
D. H. Bennett

Approved A. J. Savard
A. J. Savard

Form 624

FLIGHT REPORT

MODEL XPB2Y-4 AIRPLANE

No. 1638

Flight No. 7

Made: May 15, 1943
G. W. 72,500 lbs.
C.G.: 26.8% MAC

Purpose

The purpose of this flight was to check the general hydrodynamic characteristics of the airplane with spray strip on during simulated take-off runs, take-offs,and landings using both R-1830-88 power and R-2600-10 power.

Results

A total of five taxi runs and two take-offs was made using R-1830-88 and R-2600-10 power. All runs were satisfactory. No porpoising was encountered.

At PB2Y-3 power (2400 RPM - 33 "Hg. manifold pressure - 1200 BHP), the take-off time was 168* seconds and the take-off speed was approximately 80 knots. Light spray came in contact with the propellers for a period of approximately 12 seconds.

At XPB2Y-4 power (2800 RPM - 43 "Hg. manifold pressure - 1700 BHP), the take-off time was 39* seconds and the take-off speed was approximately 92 knots. Light spray came in contact with the propellers for a period of approximately 5 seconds.

Both landings were satisfactory with no skipping tendencies present.

*Take-off time corrected to 0 wind.

CONSOLIDATED AIRCRAFT CORPORATION
SAN DIEGO, CALIFORNIA

FLIGHT REPORT

Model XPB2Y-4 Airplane No. 1638

Flight No. 8 Date May 17, 1943

Date of Report: JUL 1 1943

By R. C. Crowther
R. C. Crowther

Checked A. J. Nadeau
A. J. Nadeau

Approved D. H. Bennett
D. H. Bennett

Approved A. J. Savard
A. J. Savard

Form 624

FLIGHT REPORT

MODEL XPB2Y-4 AIRPLANE

No. 1638

Flight No. 8

Made; May 17, 1943
G.W.: 74,000 lbs.
C.G.: 26.4% MAC

Purpose

The purpose of this flight was to make simulated take-off runs, take-offs, and landings using R-2600-10 power.

Results

A total of four taxi runs and one take-off and landing was made, using the power described above.

Run #1 was made using 0° flap and 0° elevator. Light spray came in contact with the propeller for a period of approximately 6 seconds. No porpoising was encountered. Run #2 was made with 10° flap and 0° elevator. A maximum of 5° porpoise was encountered. Run #3 was made using 20° flap and 0° elevator. Light spray came in contact with the propellers for a period of approximately 5 seconds, and a maximum of 5° porpoise was encountered. Run #4 was made with 20° flap and 10° elevator. No signs of porpoising were noticed.

A normal take-off was made using 0° flap to the hump and then 20° flap. The take-off time was 42* seconds, take-off speed 80 knots, and take-off trim 5°. The landing was satisfactory.

Pilot's comments were that the airplane handled very well at this high gross weight and that the ailerons corrected most of the directional yaw caused by propeller torque.

*Take-off time corrected to 0 wind.

CONSOLIDATED AIRCRAFT CORPORATION
SAN DIEGO, CALIFORNIA

FLIGHT REPORT

Model XPB2Y-4 Airplane No. 1638

Flight No. 9A and 9B Date May 19 and 24, 1943

Date of Report: JUL 1 1943

By R. C. Crowther
R. C. Crowther

Checked A. J. Nadeau
A. J. Nadeau

Approved D. H. Bennett
D. H. Bennett

Approved A. J. Savard
A. J. Savard

Form 624

FLIGHT REPORT

MODEL XPB2Y-4 AIRPLANE

#1638

Flight 9A&9B G.W.: 76,000 lbs.

Purpose

The purpose of these tests was to determine the forward and aft limits of hydrodynamic stability.

Results

A total of 21 taxi runs was made with C.G. locations as far forward as 23% and as far aft as 31% MAC.

The hydrodynamic stability of the airplane was determined at 76,000# gross weight and is summarized in the following table:

Flap Deflection (Degrees)	Elevator Deflection (Degrees)	Fwd. Limits (% MAC)	Aft Limits (% MAC)
0	0	25.5	33
0	5	24.5	31
0	10	23	-
10	0	27	34+
10	5	25.5	-
10	10	24.0	-
20	0	29	34+
20	5	27	-
20	10	25.5	-

Note: No up elevator exceeding 5° should be used with C.G. locations aft of 29% MAC.

It was noted during the taxi runs that the airplane yawed when the flaps were deflected. No throttle control was necessary with 0° flap deflection.

CONSOLIDATED AIRCRAFT CORPORATION
SAN DIEGO, CALIFORNIA

FLIGHT REPORT

Model XPB2Y-4 Airplane No. 1638

Flight No. 10 Date May 25, 1943

Date of Report: JUL 1 1943

By R. C. Crowther
R. C. Crowther

Checked A. J. Nadeau
A. J. Nadeau

Approved D. H. Bennett
D. H. Bennett

Approved A. J. Savard
A. J. Savard

Form 624

FLIGHT REPORT

MODEL XPB2Y-4 AIRPLANE

No. 1638

Flight No. 10

Made: May 25, 1943
G.W.: 76,000 lbs.
C.G.: 27.1% MAC

Purpose

The purpose of this flight was to make taxi runs and take-offs using R-2600-10 power (1700 BHP and 1800 BHP).

Results

A total of two taxi runs and two take-offs was made. The two taxi runs were made primarily for the purpose of photographing spray characteristics, the first run at 1700 BHP and the second at 1800 BHP. Both runs were satisfactory. No porpoising was encountered.

The first take-off was made at 1700 BHP, using the normal procedure, that is, zero degrees flap to the hump and then 20° flap. Take-off time was 50.5* seconds, take-off trim 4½°, and take-off speed 96 knots. The second take-off was made at 1800 BHP, using the same procedure as above. Take-off time was 43* seconds, take-off trim 5°, and take-off speed 93 knots. Both landings were normal step landings with landing trims of 6½ and 5 degrees, respectively. No skipping tendencies were present.

*Take-off time corrected to 0 wind.